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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte, AKIKO FUJINO and TSUMORU OHATA

Appeal 2009-003566
Application 10/555,447
Technology Center 1700

Decided: August 19, 2009

Before CATHERINE Q. TIMM, MICHAEL P. COLAIANNI, and
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's
decision rejecting claims 1-8. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

I. STATEMENT OF THE CASE

The invention relates to a lithium secondary battery, which includes
the use of a non-woven fabric as a separator between a positive and negative

electrode and a porous film adhered to the surface of at least one of the positive electrode and negative electrode (Spec. ¶¶ 1, 14, and 20). Claim 1 is illustrative of the subject matter on appeal:

1. A lithium secondary battery comprising:
 - a positive electrode comprising a composite lithium oxide;
 - a negative electrode comprising a material capable of absorbing and desorbing lithium;
 - a separator interposed between said positive electrode and said negative electrode; and
 - a non-aqueous electrolyte,

wherein said separator comprises non-woven fabric, at least one of said positive electrode and said negative electrode has a porous film that is adhered to a surface thereof, and said porous film comprises an inorganic oxide filler and a binder.

The Examiner relies on the following prior art references to show unpatentability:

Yamashita et al. (“Yamashita”)	US 6,287,720 B1	Sep. 11, 2001
Fujiwara et al. (“Fujiwara”)	US 6,576,366 B1	Jun. 10, 2003
Shi et al. (“Shi”)	US 2005/0014063 A1	Jan. 20, 2005

The Examiner maintains the following rejections:

1. Claims 1, 2, and 5-8 rejected under 35 U.S.C. § 103(a) as obvious over Yamashita in view of Fujiwara; and
2. Claims 3 and 4 rejected under 35 U.S.C. § 103(a) as obvious over Yamashita in view of Fujiwara and Shi.

II. FIRST REJECTION

With respect to the first rejection, Appellants present arguments only with respect to claim 1 (Br. 5-8). Accordingly, we decide this Appeal on the

basis of representative independent claim 1. *See* 37 C.F.R. § 41.37(c)(1)(vii) (“When multiple claims subject to the same ground of rejection are argued as a group by appellant, the Board may select a single claim from the group of claims that are argued together to decide the appeal with respect to the group of claims as to the ground of rejection on the basis of the selected claim alone.”).

A. ISSUE ON APPEAL

The Examiner contends that Yamashita and the Background Art section of Appellants’ Specification suggest that a person of ordinary skill in the art would have used either a non-woven fabric or a polyethylene microporous film as a separator (Ans. 7 and 17).

Appellants contend that Table 1 and Table 2 of Appellants’ Specification shows that a polyethylene separator and a non-woven fabric separator are not equivalent because the characteristics of batteries having these two materials are significantly different (Br. 6-7; Reply Br. 4). The Examiner responds that the difference in characteristics does not negate that the materials are art recognized equivalent materials for battery separators (Ans. 16-17).

Appellants also contend that Tables 1 and 2 demonstrate the combination of a non-woven cloth separator and a porous film exhibits superior unexpected results (Br. 5-6). The Examiner contends that the data is not sufficient to demonstrate an unexpected or significant difference (Ans. 8-12). The Examiner further contends that the data does not show unexpected results for the entire scope of the invention, particularly for non-woven fabrics other than polypropylene and polypropylene-polyamide non-

woven fabrics and for inorganic oxide fillers other than alumina and titania (Br. 15-16).

The following two issues arise from the contentions of Appellants and the Examiner: (1) have Appellants shown that the Examiner reversibly erred in finding that one of ordinary skill in the art would have substituted the non-woven fabric taught by Fujiwara for the polyethylene film taught by Yamashita as a separator in a lithium cell battery; and (2) is Appellants' evidence of unexpected results sufficient to overcome the Examiner's determination of obviousness?

B. FACTUAL FINDINGS

The following Findings of Fact (FF) are relevant to deciding the above identified issue on appeal:

1. The use of non-woven fabrics have been proposed "instead of the separator made of a microporous film" composed of a polyolefin resin, such as polyethylene (Spec. ¶ 3 and 5).

2. A non-woven film is inexpensive and has a high ability to retain a non-aqueous electrolyte, where a microporous film has a low ability to retain a non-aqueous electrolyte leading to a lower capacity due to electrolyte depletion (Spec. ¶ 4-5).

3. Microporous films and non-woven fabrics are equally susceptible to breakage due to heat generated by short-circuit reactions that occur if the battery is penetrated and to shrinking or melting if exposed to temperatures of 150°C or more (Spec. ¶ 8).

4. Fujiwara teaches the use of either a polyethylene microporous film or a non-woven cloth as materials of separators for a non-aqueous electrolyte secondary cell (Fujiwara, col. 9, ll. 27-35).

5. Appellants' Specification is silent as to the expected or unexpected nature of the results provided in Table 2 (*see generally* Spec.).

6. The closest prior art, i.e., Yamashita, which teaches using a polyethylene film separator and a porous film, is represented in the data of Table 2 by Comparative Example 4 (Yamashita, Example 6, col. 29, l. 44-col. 32, l. 11; Spec. Tables 1 and 2).

7. Examples 1-24 show consistent improvement over Comparative Example 4 only in capacity retention rate and nail penetration safety, but only at slow nail speeds (5 mm/s). Examples 1-24 show no clear and consistent improvement over Comparative Example 4 for any other category, including nail penetration safety at high speed (180 mm/s). (Spec. 36, Table 2.)

8. Examples 1-24 have a range of capacity retention rates at 300 cycles from 91-95%. Comparative Example 4 has a capacity retention rate at 300 cycles of 88%. (Spec. 36, Table 2.) Thus, Examples 1-24 show an improvement over Comparative Example 4 by as little as 3%.

9. Examples 1-24 have temperatures of 65-78° C after 1 second when penetrated with a nail at a speed of 5 mm/s. Comparative Example 4 has a temperature of 80° C after 1 second when penetrated with a nail at a speed of 5 mm/s. (Spec. 36, Table 2.) Thus, Examples 1-24 show an improvement over Comparative Example 4 by as little as 2° C.

10. Examples 1-24 have temperatures of 86-139° C after 90 seconds when penetrated with a nail at a speed of 5 mm/s. Comparative Example 4 has a temperature of 149° C after 90 seconds when penetrated with a nail at a speed of 5 mm/s. (Spec. 36, Table 2.) Thus, Examples 1-24 show an improvement over Comparative Example 4 by as little as 10° C.

11. Examples 1-22 each have a polypropylene non-woven fabric separator and a porous film using alumina as the filler material. Example 23 has a polypropylene non-woven fabric separator and a porous film using titania as the filler material. Example 24 has a polypropylene-polyamide non-woven fabric separator and a porous film using alumina as the filler material. (Spec. 36, Table 1.)

C. PRINCIPLES OF LAW

“On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.”

In re Kahn, 441 F.3d 977, 985-86 (Fed. Cir. 2006) (emphasis omitted).

“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). The question to be asked is “whether the improvement is more than the predictable use of prior art elements according to their established functions.” *KSR*, 550 U.S. at 417. “Express suggestion to substitute one equivalent for another need not be present to render such substitution obvious.” *In re Fout*, 675 F.2d 297, 301 (CCPA 1982); *see also KSR*, 550 U.S. at 417 (“If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability.”).

A patent applicant can “rebut a *prima facie* case of obviousness by showing ‘unexpected results,’ *i.e.*, showing that the claimed invention possesses a superior property or advantage that a person of ordinary skill in the art would have found surprising or unexpected.” *See In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997) (quoting *In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995)). “[W]hen unexpected results are used as evidence of

nonobviousness, the results must be shown to be unexpected compared with the closest prior art.” *In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991).

While evidence of substantially improved results may be sufficient to support a specification’s assertion that the results are unexpected without evidence to the contrary, evidence of mere improvement in properties over the prior art alone are not sufficient to support a mere assertion that the results are surprising or unexpected. *Geisler*, 116 F.3d at 1470 (distinguishing *In re Soni*, 54 F.3d 746, 750-751 (Fed. Cir. 1995)); *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984) (“It is well settled that unexpected results must be established by factual evidence. Mere argument or conclusory statements in the specification does not suffice.”).

Further, evidence of unexpected results must be commensurate in scope with the claimed subject matter. *See In re Harris*, 409 F.3d 1339, 1344 (Fed. Cir. 2005) (“Even assuming that the results were unexpected, Harris needed to show results covering the scope of the claimed range. Alternatively Harris needed to narrow the claims.”); *In re Greenfield*, 571 F.2d 1185, 1189 (CCPA 1978) (“Establishing that one (or a small number of) species gives unexpected results is inadequate proof, for ‘it is the view of this court that objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.’”) (quoting *In re Tiffin*, 448 F.2d 791, 792 (CCPA 1971)).

D. ANALYSIS

Applying the preceding legal principles to the Factual Findings in the record of this appeal, we determine that the Examiner has established a *prima facie* case of obviousness. We agree with the Examiner that Fujiwara

and the Background Art section of Appellants' Specification present sufficient evidence that one of ordinary skill in the art would have considered a non-woven fabric and a polyethylene microporous film to be interchangeable materials for a separator in a lithium secondary battery (FF 1-4). Substituting a non-woven fabric for the polyethylene microporous film in the lithium secondary battery taught by Yamashita would have been no more than the use of a familiar element (the non-woven fabric) according to its known function (as a separator).

We also agree with the Examiner that, so long as the one of ordinary skill in the art would have considered both materials suitable for a separator, it is not necessary for a determination of obviousness that the polyethylene microporous film and the non-woven fabric, in fact, function identically as a separator. The data presented by Appellants as showing that lithium batteries containing the materials have different properties does not negate the fact that one of ordinary skill in the art would have understood that either material would adequately function as a separator. Accordingly, Appellants have not shown that the Examiner reversibly erred in finding that one of ordinary skill in the art would have substituted the non-woven fabric taught by Fujiwara for the polyethylene film taught by Yamashita as a separator in a lithium cell battery.

We also agree with the Examiner that Appellants have not provided sufficient evidence of superior unexpected results. Since the results must be shown to be unexpected compared with the closest prior art, *Baxter Travenol Labs.*, 952 F.2d at 392, the only relevant comparison of data in Table 2 is the comparison of Examples 1-24 (examples of the claimed invention) and

Comparison Example 4 (reflecting the polyethylene film separator and porous film taught by Yamashita) (FF 5).

In comparing the results from Examples 1-24 and Comparison Example 4, we find that Examples 1-24 consistently and clearly demonstrate improvement over Comparison Example 4 with respect to discharge capacity and nail penetration safety at slow speeds (FF 6). However, these improvements are not sufficiently substantial to support Appellants' otherwise unsupported assertion that the results were unexpected (FF 7-9).

Even if substantial, Appellants have directed us to nothing in Appellants' Specification to support Appellants' assertion that the test results of Table 2 were unexpected in light of the state of scientific knowledge at the time regarding separators for lithium cell batteries (FF 5). To the contrary, from the discussion of what was known in the art regarding microporous films, including polyethylene microporous films, and non-woven fabric in the Background Art section of Appellants' Specification, one of ordinary skill in the art would have expected that a lithium secondary battery using non-woven fabric as a separator would have a higher capacity than one using a polyethylene microporous film as a separator (FF 1-3). Similarly, Appellants have submitted no further evidence to show that one of ordinary skill in the art would consider the improvements, if any, demonstrated by Appellants' Specification would have been surprising or unexpected.

On a final note, we agree with the Examiner that the data provided for Examples 1-24 do not reflect the entire scope of the claimed invention. Claim 1 generically recites the use of a non-woven fabric and an inorganic oxide filler (claim 1). Accordingly, Examples 1-24, which use only

polypropylene and polypropylene-polyamide non-woven fabrics and which only use alumina and titania inorganic oxide fillers, do not represent the entire scope of the claimed invention, which would incorporate other non-woven fabrics and other inorganic oxide fillers. Thus, weighing all the evidence together, the evidence falls short of supporting a determination that results are unexpected for the entire scope of the claimed invention over that of the closest prior art. Therefore, Appellants' evidence of unexpected results is not sufficient to overcome the Examiner's determination of obviousness.

Appellants present no arguments with respect to claims 2 and 5-8 above and beyond those presented with respect to claim 1 (Br. 8). Accordingly, we sustain the Examiner's first rejection.

III. SECOND REJECTION

Appellants present no arguments with respect to the rejection of claims 3 and 4 based on Yamashita in view of Fujiwara and Shi, above and beyond those presented with respect to claim 1 (Br. 9). Accordingly, we sustain the Examiner's second rejection for the same reasons discussed above with respect to the Examiner's first rejection.

IV. CONCLUSION

For the reasons discussed above, we sustain the following rejections:

1. Claims 1, 2, and 5-8 rejected under 35 U.S.C. § 103(a) as obvious over Yamashita in view of Fujiwara; and
2. Claims 3 and 4 rejected under 35 U.S.C. § 103(a) as obvious over Yamashita in view of Fujiwara and Shi.

V. DECISION

We affirm the Examiner's decision.

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VI. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(v) (2008).

AFFIRMED

sld

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